# Measurement of the $^{208}$Pb($^{64}$Ni, $n$)$^{271}$Ds ($Z$ = 110) Excitation Function

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In preparation for an experiment on the production of element $^{272}$111 in the $^{208}$Pb($^{65}$Cu, $n$) reaction [1], the excitation function for the $^{208}$Pb($^{64}$Ni, $n$)$^{271}$Ds reaction was measured at the LBNL 88-Inch Cyclotron using the Berkeley Gas-filled Separator. Previous work established the cross section at one beam energy [2], and two new energies were measured in the current work. The lab-frame beam energies ($E_{cot}$) in the center of the 470-μg/cm$^2$ targets (98.4% $^{208}$Pb, 1.1% $^{207}$Pb, 0.5% $^{206}$Pb) were 314.3 MeV and 311.5 MeV, leading to compound nucleus excitation energies of 16.2 MeV and 14.1 MeV, respectively (masses taken from Ref. [3]). The total $^{64}$Ni$^{14+}$ beam doses were $2.9 \times 10^{17}$ and $2.3 \times 10^{17}$, respectively.

Preliminary results are available, and events assigned to the decay of $^{271}$Ds are shown in Fig. 1. Chains 1 and 2 were observed at $E_{cot}$ = 314.3 MeV and chains 3-7 were observed at $E_{cot}$ = 311.5 MeV. These decay chains show excellent agreement with previously published data on the decay of this nucleus [2,4-5]. $^{271}$Ds was observed to decay via alpha particle emission with a half-life of $1.6^{+0.9}_{-0.5}$ ms. Decay of the known $^{271m}$Ds isomer ($t_{½}$ = 56 ms, $E_α$ = 10709 keV) was not observed. $^{267}$Hs decayed with two half-lives of $55^{+32}_{-18}$ ms and $0.9^{+12}_{-4.5}$ ms. The latter may be due to an isomer but the current data are inconclusive. Only the decay of isomeric $^{263m}$Sg was observed. The observed $^{259}$Rf decays are consistent with known data, as are the $^{255}$No decays. Some of the latter may be due to random correlations, as the correlation time is long. The average magnetic rigidity of the evaporation residues in helium was 2.09 T m.

The observed cross sections at $E_{cot}$ = 314.3 MeV and 311.5 MeV were $7.7^{+10}_{-5.2}$ pb and $20^{+15}_{-11}$ pb, respectively. Chain 3 was not included in the latter cross section because it was observed with a set of targets later determined to be too thick for an accurate cross section measurement. These data, and the two events at $E_{cot}$ = 309.2 MeV with cross section $8.3^{+11}_{-5.3}$ pb measured in Ref. [2], establish an excitation function for the $^{208}$Pb($^{64}$Ni, $n$)$^{271}$Ds reaction.

## REFERENCES

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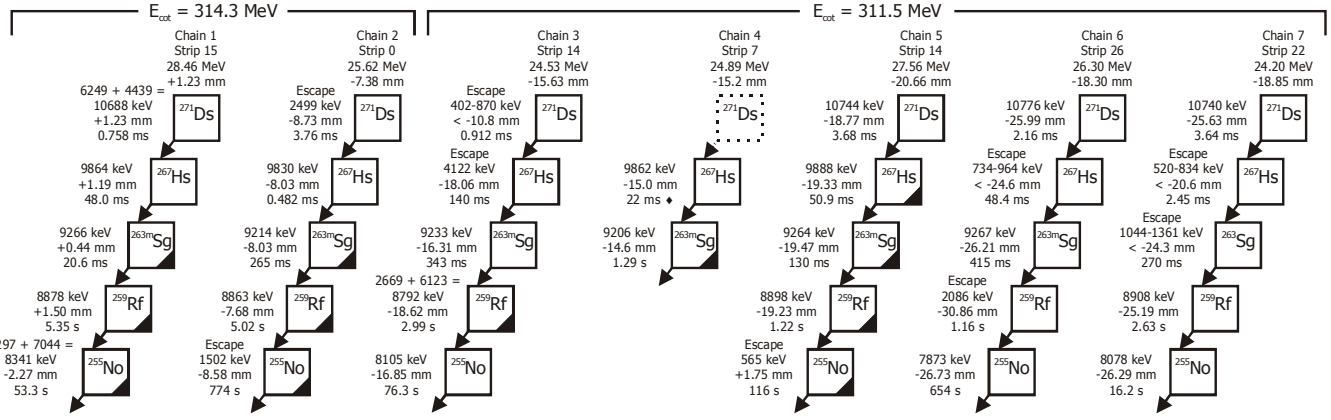


FIG. 1: Events attributed to $^{271}$Ds in the $^{208}$Pb($^{64}$Ni, $n$) reaction. The notation $x + y = z$ keV indicates an escape alpha event where $x$ keV was deposited in a strip detector and $y$ keV was deposited in an upstream detector, with sum $z$ keV. A black triangle in the lower right corner indicates the decay was observed with the beam off. Chain 4 was not observed in its entirety due to a design flaw in the data acquisition system. The lifetime marked with a diamond (♦) is the sum of the $^{271}$Ds and $^{267}$Hs lifetimes.